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DEPARTMENT OF AGRICULTURE

BULLETIN

SACRAMENTO, CALIFORNIA

JANUARY-FEBRUARY-MARCH
1954

COMMONWEALTH MYCOLOGICAL
30 APR 1954

STATE OF CALIFORNIA

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THE BULLETIN

Official Bulletin of the Department of Agriculture, devoted to Agriculture in its broadest sense. Sent free to citizens of California and offered in exchange for bulletins of the Federal Government, Experiment Stations, and other publications of a similar nature. Published Quarterly.

W. C. JACOBSEN ..... Acting Director
EDNA WILLIS GASKILL ..... Editor

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ANSON ALVIN BROCK

DIRECTOR A. A. BROCK RETIRES FEBRUARY 1, 1954

After almost 16 years as Director of the California State Department of Agriculture, on the advice of his physician, Anson Alvin Brock resigned effective February 1, 1954. Director Brock's letter of resignation which Governor Goodwin J. Knight accepted with regret follows:

"I should like to be relieved of my present duties as of February 1st. Some time ago my doctor suggested that it would be well if I would give up my responsibilities here.

"I have a few private undertakings and I should like to devote all my time to them. These alone, I believe, will demand about all my energies.

"Your favorable and prompt action on this will be appreciated."

Born in Halfway, Missouri, January 16, 1889, A. A. Brock was educated in the public schools. He studied law at home and was admitted to the California Bar in 1929, and later to practice before the U. S. Supreme Court. Although versed in the law, his prime interest has been in agriculture and in the enforcement of the California Agricultural Code and related statutes.

For two years Mr. Brock was a county horticultural inspector in Ventura County, starting in 1912. He then served as Horticultural Commissioner from 1914-1921. For two years he was field man in charge of pest control for the Santa Paula Citrus Association, also in Ventura County. He was Agricultural Commissioner in Orange County for 11 years. In 1923, shortly after the creation of the State Department of Agriculture, Mr. Brock was elected President of the State Association of County Agricultural Commissioners. On February 24, 1933, Governor James Rolph appointed him Director of Agriculture. He held office until March 31, 1939, when he resigned to become manager of the Placerville Fruit Growers' Association. Governor Earl Warren reappointed him on March 31, 1944.

As a member of the Agricultural Research Policy Committee and the Agricultural Mobilization Board of the U. S. Department of Agriculture, Mr. Brock was frequently called to Washington, D. C., to advise on problems of national importance to agriculture. He is a former president of the National Association of Commissioners, Secretaries and Directors of Agriculture.

For many of the years of his administration, California was the top ranking state nationally in agricultural income and as Mr. Brock concluded his long and highly successful service, agriculture, generally speaking, was in sound condition. The State Board of Agriculture passed unanimously the following resolution commending his services:

"WHEREAS, The California State Board of Agriculture has been advised by Anson A. Brock of his plan to retire on February 1, 1954, from his position as Director of the California State Department of Agriculture for reasons of health; and

"WHEREAS, The people of the State of California and its agricultural industry have benefited by the long and effective service rendered by Mr. Brock in his capacity as Director of Agriculture for 16 years, following comparable county service as Agricultural Commissioner for Ventura and Orange Counties; and

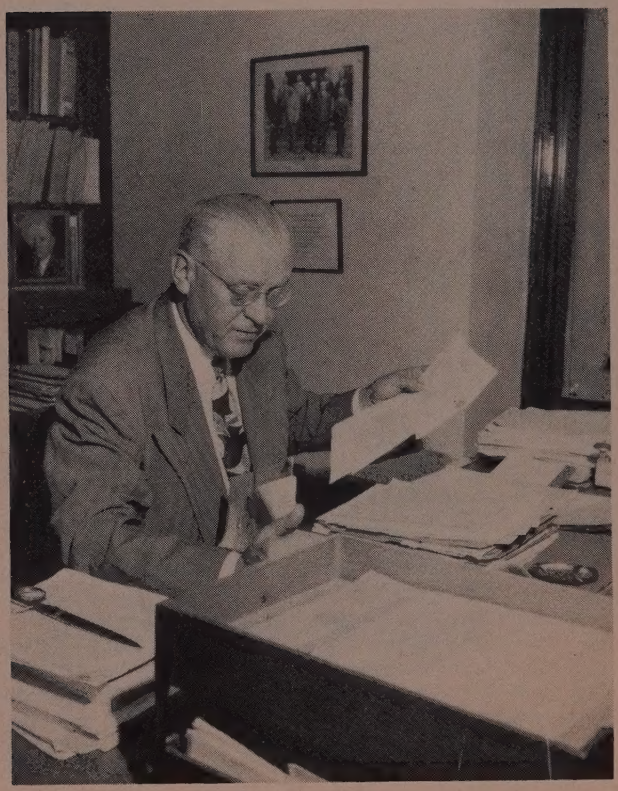
"WHEREAS, During this period he has evidenced keen recognition of the problems of the agricultural industry and has given wise and intelligent leadership, in addition to furnishing a businesslike administration of the agencies in his charge; and

"WHEREAS, He has diligently carried out every responsibility in administering the laws in keeping with the objectives sought by the Legislature; and

"WHEREAS, He has maintained cordial and excellent cooperative relationships with the State Board of Agriculture during his tenure; now, therefore, be it

"*Resolved by the California State Board of Agriculture, in regular meeting at Sacramento this eighteenth day of January, 1954, upon motion duly made, seconded and unanimously carried,* That said board does hereby express appreciation collectively and as individual members for his cooperation; commend him for dutiful and unstinting service; and express its wish for a long continuing period of healthful and enjoyable retirement."

Mr. and Mrs. Brock will make their home in Placerville, El Dorado County, where they have extensive fruit ranch interests.



W. C. JACOBSEN

W. C. JACOBSEN SUCCESSOR TO A. A. BROCK

W. C. Jacobsen, Deputy Director since July 1, 1953, a widely known and popular state civil service employee and a veteran of 36 years with the State Department of Agriculture, was named Acting Director of the Department by Governor Goodwin J. Knight following the resignation of A. A. Brock. He is one of the few employees of the department who was associated with the office of State Commissioner of Horticulture, predecessor to the present Department of Agriculture. Mr. Jacobsen served under an interim appointment as director in 1931.

Born in California, Mr. Jacobsen lived 12 years on a ranch in Arizona in his early youth. He is a graduate of the University of California (1916) and the McGeorge College of Law, receiving his law degree in 1937. He worked for the U. S. Biological Survey on a part-time basis from 1913 to 1916 while attending the university and after graduation he assumed charge of that agency's rodent and predator control program in California. At the request of the late Commissioner of Horticulture George H. Hecke, he became state superintendent of rodent control for that commission in 1918.

When the Department of Agriculture was organized, Mr. Jacobsen served as department zoologist, 1920-1923; Chief of the Bureau of Plant Quarantine and Pest Control, 1924-1931; Acting Director of Agriculture, 1931; in charge of rodent, plague and weed control activities, 1933-1940; Chief of the Bureau of Rodent and Weed Control and Seed Inspection, 1941-1944; Chief of the Division of Plant Industry, 1944-1949; Assistant to the State Director of Agriculture, 1949-1953; Deputy Director, 1953-1954.

C. J. Carey, Chief of the Division of Marketing, was made Deputy Director. Mr. Jacobsen's former duties at the Legislature will be assumed by Chas. V. Dick, Chief of the Division of Plant Industry. Dr. Arthur G. Boyd, Assistant to the Director, will remain in that post, and also administer the animal industry features associated with the director's office.

The Acting Director has been legislative representative of the department since 1929 and Assistant Secretary and Secretary of the State Board of Agriculture since 1933. Since 1940 he has been Executive Secretary of the California State Commission on Interstate Cooperation, and since 1949 Secretary of the Western Interstate Committee on Agriculture of the Council of State Governments.

Mr. Jacobsen announced that he would maintain the policies and programs that had proved so successful and beneficial to the people of the State under A. A. Brock.

3—93638

ERGOT ON PASTURE GRASSES IN RELATION TO CONVULSIVE ERGOTISM IN LIVESTOCK

Mrs. Margaret K. Bellue, Weed and Seed Botanist,
Department of Agriculture

The frequent recurrence of an unexplained nervous disorder in cattle in the upper San Joaquin Valley occasioned field investigations which resulted in the classification of the trouble as the convulsive or nervous type of ergotism. Most of the early cases developed in animals which were on dominantly ryegrass pastures, some on Dallis grass.

In a heavily ergotized field, practically all of the grass seed-spikes will have been ingested from 10 days to two weeks after the animals have access to them. In instances where the amount of ergot has been adequate to provide the toxic dose, symptoms of convulsive ergotism are convincingly exhibited when the animals are driven or forced to move. Staggering gait, trembling or twitching of the muscles, nervous paroxysms during which animals fall, may or may not be followed by paralysis. Recovery is usually rapid if stock are shifted to new pasture or fed on hay. Cattle lost through the influence of ergot poisoning have in the majority of cases either fallen down out of reach of food or have drowned in shallow water.

Ergot, the mature sclerotium or resting stage of the fungus *Claviceps purpurea,* is recognizable on most grasses as a dark-violet to black "spur" (Fig. 1) in place of and conspicuously longer than the normal grass grain. Except in those unfortunate cases where it is grazed off, ergot is harvested with the seed or falls to the ground.

In contact with the ground and under favorable conditions (a period of cold followed by heat and humidity) ergot germinates. Millions of minute spores (ascospores) are ejected from mushroom-like outgrowths (Fig. 2) and carried upward by air convection currents. Some of these spores make contact with the embryonic seed during the short period the grass flowers are open, and this is the only stage at which ergot infection can be initiated.

Six to eight days after the primary infection, a sticky exudate, "honeydew," develops, in which other spores (conidia) are embedded. Conveyed by the "honeydew," these spores drop to flowers lower on the stem and also are carried to other plants by insects, moving animals and swaying grass stems, thus spreading the ergot over the fields through secondary infection.

Dallis grass is responsible for numerous outbreaks of convulsive ergotism, but because ergot sclerotia are singularly difficult to detect on this grass it often escapes incrimination. Dallis grass ergot, *Claviceps paspali,* does not form dark spur-like enlargements, but develops irregularly spherical, light pinkish-tan bodies which do not differ greatly from the seeds whose position they usurp. (Fig. 1.) Detection is further obscured by the presence of secondary fungi such as *Clado-*

FIGURE 1. Ergot on ryegrass, *Lolium* (left), and wildrye, *Elymus* (center), showing dark "spurs." Ergotized Dallis grass (*Paspalum*), (right), showing slight blackening due to spores of other fungi adhering to "honeydew." Ergotized florets of Dallis grass differ little in outward appearance from normal florets.

FIGURE 2. Bottom, germinating ergot sclerotium. Top, more advanced stage showing stroma from which ascospores have been ejected. Enlarged.

sporium and *Fusarium* growing on the sticky exudate which spreads over the heads in the "honeydew" stage.

Dallis grass is of particular interest in California because it is not only widely utilized as a pasture constituent, but also occurs spontaneously along ditches, roadsides and fencerows.

Among the ergotized grasses of lesser importance submitted to our Bureau from coastal as well as interior counties during 1953 were: wild ryes, tall fescue, meadow fescue, reed canarygrass, redtop, orchard grass, tall meadow oatgrass, barley. From the standpoint of being directly responsible for livestock losses, ergot on these grasses is unimportant; they are a factor, however, in that they harbor the rye ergot, *Claviceps purpurea.*

Ergot infection cannot take place, and consequently injury to livestock does not occur, under a system of close grazing. If the grass is in the flowering stage and weather conditions favoring the growth of ergot obtain, stockmen should endeavor to apprehend this fungus in the "honeydew" stage. Regard the presence of "honeydew" as a warning. See that the grass is eaten down, or mowed, prior to development of seed heads.

NECROTIC LEAF SPOT OF PEACH AND ITS EFFECTS ON JUNE-BUDDED NURSERY STOCK [1]

H. Keith Wagnon, Associate Plant Pathologist and
James R. Breece, Junior Plant Pathologist
Bureau of Plant Pathology, California Department of Agriculture

Necrotic leaf spot is a mild virus disease which is known to produce symptoms only upon peach, *Prunus persica* (L.) Batsch, and nectarine, *P. persica* var. *nectarina* (Ait.) Maxim. The first observations of this disease were made in Michigan by Cation (1) in 1940 on two trees each of Elberta and Carman varieties which had been inoculated in 1939 with buds from a Windsor sweet cherry tree growing in East Lansing, Michigan. In subsequent transmission work, Cation (1,2) obtained leaf symptoms on several other peach varieties, but was unable to produce symptoms on inoculated trees of Windsor, Black Tartarian and Royal Anne (Napoleon) sweet cherry (*P. avium* L.) varieties and Montmorency, a sour cherry (*P. cerasus* L.) variety. He concluded, after making additional tests, that the sweet cherry varieties were symptomless carriers and pointed out that, as a result of the distribution of this virus in latent form in sweet cherry by nurseries, it may be widespread in that species. Aside from his own tests, Cation (2) also reported Dr. L. C. Cochran finding necrotic leaf spot in sweet cherry in California by indexing cherry on peach.

Although a number of contemporary workers in stone fruit viruses are familiar with leaf symptoms of this virus on peach and nectarine, apparently there is no report in the literature of its natural occurrence on these hosts. The disease probably is much more prevalent and widespread in the United States than is generally realized. Cochran has observed it on peach in California and Georgia and has also observed it on trees originating in Missouri.[2] Surveys have shown it to be very widespread in California. It is very probable, as was the case of the writers when they first encountered this disease, that the symptoms are being confused by some workers with those caused by ring spot virus (3).

Symptoms of necrotic leaf spot were frequently observed during the growing seasons of 1951, 1952, and 1953 while making inspection of peach and nectarine scion and budwood sources in California.[3] Although not the same in all respects, the symptom picture in California

[1] Work done under Research and Marketing Project number RM: C-432-27, for which state funds were matched with federal funds received from the Production and Marketing Administration, United States Department of Agriculture, under provisions of the Agricultural Marketing Act of 1946.

[2] Correspondence with Dr. L. C. Cochran, October 7, 1952.

[3] Symptomatic leaves submitted to Dr. L. C. Cochran were diagnosed as being typical for peach necrotic leaf spot.

is essentially that as described for Michigan. Brown or sometimes purple areas, which seemingly may or may not be preceded by chlorotic spots, usually appear on young unfolding leaves of affected trees. On some occasions in California, however, leaves have been observed to be completely expanded before visual symptoms became evident. The necrotic spots are round to irregular in shape and eventually drop out leaving a clean-edged margin. An affected leaf may develop only one to several necrotic areas (see Fig. 1) or it may have many necrotic areas which often coalesce. Thus, after the necrotic areas fall out, a leaf may be sparsely to much perforated or, in severe cases, it may be partially to almost completely disintegrated. In California it has been observed that on very young and rapidly growing orchard and nursery trees, the severely affected leaves may drop within one or two weeks following the appearance of the necrotic spots. This is at variance with observations in Michigan where the affected leaves on orchard trees are reported not to drop prematurely.

Under conditions in Michigan rarely more than one or two affected leaves have been observed on any one particular growing shoot. In California, however, it is not uncommon to find as many as four affected leaves per shoot on mature trees and, in young June-budded trees in the nursery row, as many as eight affected leaves have been found per shoot with one to five of them frequently falling prematurely. In the nursery rows, such affected trees are often arrested in their development and can usually be seen to be somewhat shorter in height than adjacent trees which are growing normally.

In Michigan, Cation (1) observed that inoculated nursery row peach seedling trees may exhibit a dieback on one or more shoots of the cur-

FIGURE 1. Leaves from June-budded nursery peach tree of the Peak variety showing normal leaf on left and six leaves affected by necrotic leaf spot. Note the deformity and areas where necrotic tissue has fallen away. Photographed August 21, 1953, by Roy M. Nakayama, California Department of Agriculture.

rent year's growth two to three weeks after bud break. No such dieback of the current growth has been observed in California on June-budded and yearling nursery row trees which were apparently propagated from budwood infected with this virus. However, such infected nursery row stock cannot be regarded as a duplication of Cation's inoculation tests carried out in Michigan.

This virus may be distinguished from ring spot virus by symptoms that usually do not appear on leaves formed early in the season but develop on those unfolding during periods of high temperatures in midsummer. Symptoms of ring spot usually occur on leaves which develop early in the growing season. Also, necrotic leaf spot symptoms may appear year after year, whereas ring spot becomes latent after the initial symptoms which appear subsequent to infection.

The foliage symptoms caused by this virus may also be confused with those caused by the coryneum blight or shot-hole disease fungus, *Coryneum beijerinckii* Oud. (4). Although the lesions caused by this fungus first appear as purplish round spots, as do those of necrotic leaf spot on some occasions, they differ by having a yellowish center. However, as the lesions increase in size, the yellowish center disappears and the central tissues turn brown. As in necrotic leaf spot, the necrotic areas of coryneum blight eventually separate from the healthy tissue, producing the shot-hole effect. Leaf symptoms of coryneum blight apparently are rather infrequent on June-budded peach trees in the nursery rows in California. Wilson (4) has pointed out that leaf infection by this fungus is dependent upon rainfall, and that infection apparently does not occur unless the leaves remain moist for 24 hours or more while the spores are on them. The relatively dry atmosphere and high summer temperatures which prevail where most of California's stone fruit nursery trees are grown apparently are not favorable for the development of this fungus on the leaves of June-budded stock. This seems to be true also where overhead irrigation is practiced.

Necrotic leaf spot has very little effect upon a mature tree, hence has been regarded to be of little significance. In California where it is a common nursery practice to June-bud seedling peach trees grown from seed during the current season, it has been found that the virus can be of economic importance when budwood contaminated with this virus is used. The damage caused is subsequent dwarfing as a result of the premature falling of seriously affected leaves during a critical growing period when a June-bud is being forced into rapid growth. It is a peculiarity of this virus that it produces its severest leaf symptoms during hot weather on tender and vigorous shoots such as are produced on nursery and orchard trees growing under ideal conditions. In California, the critical period for development of shoot growth from June-buds frequently coincides with the time at which the virus apparently is activated by high temperatures. This often results in the loss of the more seriously affected leaves. If the bud has developed into a shoot of only several inches to a foot in length, the loss of a few leaves can greatly retard growth of the plant. Since the foliage of the seedling rootstock is removed above and below the June-bud in order to force it into rapid growth, all the leaves of the developing shoot are greatly needed for the manufacture of foods which are essential for rapid

growth. Indeed, it is this rapid growth which nurserymen rely upon for producing June-budded trees of marketable size in one growing season.

TABLE 1

Peach and Nectarine Varieties Known to Exhibit Leaf Symptoms of Peach Necrotic Leaf Spot

PEACHES

Alamar	Gaume	Paloro
Altair	Giblin	Peak
Andora	Gold Dust	Redhaven
Babcock	(Plt. Pat. #1144)	Redwing
Blazing Gold	Golden Blush	Rio Oso Gem
Carman *	Golden Jubilee *	S-37 (Plt. Pat. #904;
Carolyn	Gomes	rootstock variety)
Coronado	Halehaven †	Shasta
Cortez	Halford No. 2	Sierra
Curry	Hiraoka Flame	Silver Lode
Dixiered	Indian Free	Sim
Early Babcock	Jerseyland	South Haven *
Early Elberta	J. H. Hale †	Southland
Early Halehaven	J. L. Ames	Sowell
Early Robin	Krummels October	Springtime
Elberta †	Late Haven	Starking Delicious
Farida	Libbee	Strawberry Free
Faye Elberta	Lovell	Sungrand
Fertile Hale †	McKevitt	Three Star
Fireglow	Meadow Lark	Tulip
Flamingo	Merrill Splendor	Two Star
Florence	Muir	Vivian
Fontana	Nectar	Weldon
Fortuna	One Star	White Heath
Four Star	Orange Cling	Williams

NECTARINES

Beacon	Guy Philp	Merrill Sunrise
Early Le Grand	Howard	Pioneer
Freedom	Kim	Quetta
Gold Mine	Le Grand	

* Reported by Cation (2).
† Varieties reported by Cation (2) and also seen by the authors; varieties not marked by asterisks were seen by the authors.

Symptoms have been observed on 84 varieties (see table 1) of peaches and nectarines, and it is believed that all varieties of these two fruits probably are susceptible. The varieties apparently vary in the severity of symptom expression. Severest symptoms have been observed on Peak, Paloro, Faye Elberta, Halford No. 2, Gold Dust and Hiraoka Flame peach varieties and on Freedom nectarine. The expression of symptoms apparently is influenced by environmental factors, particularly temperature, and other conditions which induce rapid and tender growth. On mature trees, the symptomatic leaves frequently are confined to twigs having a southern exposure.

Peaches and nectarines are the only stone fruits known to show symptoms of this virus. However, the host range has not been completely investigated. Sweet cherries and possibly sour cherries [4] also may carry this virus in latent form. No symptoms have been observed

[4] Tests made by Cation were not conclusive as his inoculated trees of Montmorency which showed no symptoms also carried ring spot as a latent virus.

on almond, *P. amygdalus* Batsch, when top-worked upon peach trees known to be contaminated with this virus. However, symptoms have been seen on rootstock sprouts of one-year-old almond trees budded on peach; hence it is very probable that almond is also a symptomless carrier of the virus.

Transmission of peach necrotic leaf spot is readily accomplished by budding and grafting. There is no evidence of a natural spread in the nursery or orchard. The evidence indicates that this virus has been increased and distributed through the use of contaminated scion and budwood material.

Effective control of this virus may be accomplished through the use of healthy rootstock, scion and budwood sources for propagation of nursery stock. Caution also should be exercised when budding or grafting new varieties onto established trees for the purpose of propagating or perpetuating the varieties. A new variety which is virus free can become contaminated by establishing it on an infected understock or tree.

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DEATH TAKES WILLIAM H. WRIGHT, RIVERSIDE COUNTY AGRICULTURAL COMMISSIONER

In Riverside, January 28, 1954, death took William H. Wright, Riverside County Agricultural Commissioner and Administrative Assistant in charge of the Los Angeles office of the California Department of Agriculture February, 1934, until April, 1939. Death occurred in Riverside.

Mr. Wright was born in Joplin, Missouri, June 25, 1896. He attended the University of Missouri, 1917-1918, and the University of California at Berkeley, from which he obtained his degree in agriculture in 1920.

From 1920 until 1924 Commissioner Wright taught agriculture in the Fullerton Union High School. In 1924 he was employed by former State Director of Agriculture A. A. Brock as agricultural inspector in Orange County with headquarters in Santa Ana. He became Deputy Agricultural Commissioner of Orange County in 1927 and held that position until 1934 when he was appointed Administrative Assistant, State Department of Agriculture, in charge of the Los Angeles office. He served with the department in that capacity until April, 1939, when he was appointed Agricultural Commissioner of Riverside County, which position he held when he passed on.

Mr. Wright was widely known in the citrus industry, not only in Riverside County, but also throughout Southern California. He was a member of the Orange Administrative Committee as vice chairman from December, 1950, until March, 1952, when he was named chairman of the Board of Joint Trustees to terminate the order.

Mr. Wright was a member of the Riverside Kiwanis Club, the Riverside Elks Club and was past president of the State Association of County Agricultural Commissioners.

He is survived by his widow, Marcella, of Riverside, California.

TOMATO PLANT PRODUCTION IN RIVERSIDE COUNTY

W. H. WRIGHT, Agricultural Commissioner, Riverside County

The California tomato canning industry was probably motivated by three desires which stimulated production of the first desert field-grown tomato plants in the Coachella Valley for shipment to Central and Northern California in 1947. These were to lengthen the canning season; to allow for more precise planning as to the timing of their canning season; and to accelerate the harvest date to avoid damaging rains.

In answer to these needs, tomato plants were seeded on 40 acres in 1947 in the Coachella Valley. Numerous problems developed, such as serious nematode infestations which caused many rejections in destination counties. However, the economic possibilities of this enterprise were demonstrated to the extent that in 1953 over 70 million plants were grown and shipped from 382 acres. Planted at the rate of 2,000 plants per acre, this represents a field acreage for tomato production of 35,000 acres, or 35 percent of the 1953 crop of canning tomatoes in California. It further represents a gross return of $455,000 to plant growers in Riverside County. It also demonstrated that this operation presents economic advantages to the nurserymen in the Coachella Valley, the tomato grower, and the tomato packer. It would appear that it is a permanent business until a more efficient system of growing tomato plants is developed.

Following the initial plantings in 1947, the business was enlarged in 1948 to include the original grower with a new partner who had 40 acres of plants and a new grower with five acres. Many shipments were rejected for nematode infestation, but approximately 6,000,000 plants were accepted by destination counties.

The year 1949 presented problems identical to those of the preceding years, except, again the business was expanded by the same two growers to approximately 90 acres. Rejections because of nematode infestation kept pace with the expansion; however, 15 million plants were received by northern farmers. Some limited effort was made during 1949 to fumigate the planting beds with DD, but this effort did not prove successful, presumably because insufficient dosage was used.

Although in 1950 the growers were becoming quite desperate regarding the nematode problem, the total acreage was increased by the addition of 40 acres of recently developed desert land on which the first crop was tomato plants. It was noted that no nematode infestation was found on plants from this source. The remaining 90 acres were treated with six gallons Ethylene Di-Bromide per acre. This treatment did not completely eliminate nematode infestation but a marked reduction in the rejection of infested shipments resulted, with more than 23 million tomato plants accepted at destination.

In 1951 the acreage was increased to approximately 200 acres of plant beds. There were 54 million plants shipped and, although some shipments were rejected, the adoption of soil fumigation on all of the

A typical field of canning tomatoes

plant beds did result in a lower number of rejections per million plants shipped.

At this time, shipments from the Coachella Valley were billed to several Northern and Central California counties and moved to final destination under the shipping permit of any one of these counties. When shipments were rejected, the reports were sent to the several counties and were not reported back to Riverside County. Consequently, no totals on rejected shipments for this period are available.

Prior to the 1952 season, a nematode control program was presented to the tomato plant growers for their consideration and adoption. Although the complete program was not accepted by all four plant growers, consideration was given by each grower to nematode control. Treatment varied from 7 gallons EDB per acre in a single treatment to 14 in a split treatment.

Eighty-eight man-days of inspection were spent in the fields at digging time and, although three small areas were found with nematode infestation, none was found in fields under the following conditions: (1) virgin land, summer fallow, split EDB treatment, (2) virgin land, summer fallow, (3) virgin land.

The three small areas in which the infested plants were located were immediately delimited, and these, together with a large margin surrounding them, were immediately disked under.

In excess of 105 million plants were shipped to 11 California counties with no rejected shipments for nematode reported.

Recommendations for nematode control, based on knowledge gained from the 1952 experience, were drawn up and submitted to the plant growers for their adoption and use. Copies were sent to the agricultural commissioners of the counties likely to receive shipments. These recommendations were substantially the same as those presently in force.

The growers were informed that if they complied with these recommendations, the fact would be noted on the back of the shipping permit accompanying each shipment from a qualified field.

Six growers qualified 316.6 acres in eight fields, and failed to qualify 65.35 acres in four fields.

No nematodes were found in any qualified field, but some were found in two of the four unqualified fields, resulting in a total loss of 5.75 acres in one field and 0.25 acres in another. These fields failed to qualify only by reason of crop history, that is, they had been planted to nematode-susceptible crops as late as the spring of 1952.

No rejections were reported on shipments of 70 million plants grown on 382 acres. A total of 116 man-days of inspection was spent on this program and, together with the cost of transportation, more than $2,260 were contributed by the Riverside County Department of Agriculture.

In 1954 an effort will be made to treat 375 acres so they will comply with the approved treatment and handling methods for field-grown vegetable plants required for authorization to use Inter-county Nursery Stock Certificates.

Under the recent agreement for the issuance of Pinto tags, the commissioners of all counties in the agreement, except San Joaquin, Sutter and Yuba Counties, have agreed to accept vegetable plants for field planting provided they have been grown in soil treated to insure against any possible nematode infestation, using treatment and handling methods approved by the California Department of Agriculture. This treatment was approved November 3, 1953.

The approved treatment and handling methods for field-grown vegetable plants in Riverside County, required for authorization to use Intercounty Nursery Stock Certificates, follows:

> "The following treatment and handling methods are hereby approved to insure against possible nematode infestation, as provided in paragraph 2(f) of the intercounty nursery stock certificate agreement approved by the Director on October 27, 1953.
>
> 1. Parcels of property intended for growing vegetable plants must be registered with the Agricultural Commissioner on or before July 15th of the year prior to harvest of vegetable plants. Registration must show acreage and a legal description.
> 2. Except for vegetable nursery plants and cereal crops the land shall not have been cropped for three years. New desert land or virgin land shall be considered as uncropped.
> 3. All vegetable nursery plants growing on land to be registered shall be destroyed before July 15th.
> 4. Land shall be plowed or disked at intervals sufficient to prevent weed growth.
> 5. An annual program of chemical treatment shall be applied to all parcels of land required to be registered. The approved treatment is fumigation of the soil with 15 gallons of D. D. (dichloropropene-dichloropropane mixture) or with five gallons of E. D. B. (ethylene dibromide) per acre in the first treatment followed by turning the top soil layers and repeating the same treatment after 10 days, but within 30 days of first treatment.

Chemical treatment must extend not less than five feet beyond limits of the area to be planted.

6. Only soils as light as, or lighter than, Indio Loam * are eligible for chemical treatment.
7. All natural (unprocessed) organic fertilizers must be applied prior to chemical treatment.
8. After chemical treatment of the soil all farm machinery or trucks must be cleaned (steamed or washed) before entry onto the land.
9. Land to be registered shall be located in an area where the mean maximum temperature exceeds 100 degrees F. for 30 days during the year.
10. All incoming vegetable plant nursery stock handled by a grower participating in this program must be grown under the conditions set forth above.
11. Any nematode infestation found in any planting shall be immediately delimited to the satisfaction of the Agricultural Commissioner and all plants from the delimited infested area shall be destroyed.''

CONCLUSION

It has been found that the most effective inspections can be made at the field at time of digging where the plants are pulled by hand and tied into bunches, approximately 50 plants to the bunch. There are 25 bunches packed into one crate, making a total of 1,250 plants per crate. These crates are spotted conveniently to the pickers in the field, thus placing each crate in the immediate vicinity where the plants were grown. One bunch of plants per crate was checked for nematode and approximately 60 percent of all crates were checked.

These details are mentioned to illustrate that all portions of every field had representative samples taken and inspected. This inspection procedure makes it possible to immediately locate any infestation in the field and to delimit the infestation and thus destroy any and all infested plants. From time to time, samples are taken at the packing plant for further inspection and examination. During the 1952 and 1953 seasons, 175 million plants were shipped with no rejections for nematode infestation.

When this problem was first presented for a solution in 1947, no one knew the answer, and, if the program which has been developed is the answer, the growers are entitled to a large amount of credit for their willingness to follow, rather blindly, the recommendations of the Agricultural Commissioner's Office, which were made with absolutely no guarantee of ultimate success. The words ''rather blindly'' were used advisedly since these growers have spent many thousands of dollars willingly in developing a program in their determination to ship nematode-free plants.

R. M. Howie,† Chief Deputy Agricultural Commissioner, has taken a great interest in this project, devoting considerable time in working with the growers to develop a satisfactory solution. We are also indebted to the State Department of Agriculture for assistance in various phases of the problem.

* Ref. Page 515—Soil Survey Coachella Valley Area, California. A. E. Kocher, W. G. Harper, U. S. Printing Office, 1927.
† Appointed Agricultural Commissioner of Riverside County February 1, 1954.

THE IDENTIFICATION OF SEED OF THE DODDER *CUSCUTA AUSTRALIS* R. BROWN

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The seed of an unidentified dodder were found in a shipment of niger-oil seed (*Guizotia abyssinica*) that entered Los Angeles from India in the spring of 1953. Specimen seed were deposited with the California Federal-State Seed Laboratory for reference and possible identification. This species of seed is not known to have appeared in this laboratory previously.

It appeared at first that there were two species of dodder seed, for some are definitely larger in size and of a different aspect. An examination determined, however, that the larger seed are bloated, hollow, with imperfectly formed embryos, and these may be easily crushed by pressure with forceps whereas the sound seed resist firm pressure. The larger, imperfect seed are known as sterile ones and are classed as inert matter, by the official rules for the purity analyses of seed, because they are not capable of germination.

As an aid in the identification some of the seed were germinated and placed on several genera of host plants, for the dodder is a parasite which takes its food from green plants, including some of the important

FIGURE 1. Seed of the dodder *Cuscuta australis* R. Brown, magnified 6X. Top row, normal seed. Bottom row, the bloated sterile seed.

agricultural crops. When the parasitic plants had grown to the flowering and seeding stages some of them were sent to Dr. Truman G. Yuncker of DePauw University, Greencastle, Indiana, for identification.

Dr. Yuncker, an authority on this genus, promptly identified the plant as *Cuscuta australis* R. Brown, and gave the following information: It grows on a variety of host plants in Australia, New Guinea, Java, and in Asia from Turkestan, India, Eastern China, Manchuria, and Korea.

A limited test was made to determine the adaptability of *Cuscuta australis* to several genera of plants as hosts. It flourished on the stems of the Irish potato and the petunia, and on the petioles of the red beet; it grew poorly but well enough to produce seed on the coleus, but it failed to grow on the sweet potato vine.

The length of the normal seed averages 1.5 mm., with a width of 1 mm. The sterile seed are 2 mm. long, and 1.5 mm. in width. A distinguishing feature usually present is a markedly rounded hump that curves over one "shoulder" near the hilum, somewhat like that found in *Cuscuta pentagona*, or field dodder, but more pronounced. This character is often accentuated in the sterile seed. The juncture of the hump at an angle to the oval area of the hilum usually forms a notch which is distinctive among the dodders common in California, elsewhere in North America, and Europe.

WHAT'S NEW IN PLANT PATHOLOGY *

GILBERT L. STOUT, Chief, Bureau of Plant Pathology
California Department of Agriculture

On previous occasions you have heard me talk about new methods and recent developments in plant pathology, and you have heard me report on some of our work in the bureau and with the counties. Today I shall endeavor to bring you further up to date under the general heading of what's new in plant pathology. I suspect that you are interested not only in our own work in California but also in what is going on elsewhere. There are several fields in which current research is either very active or especially interesting.

ANTIBIOTICS AND CHEMOTHERAPY

You have heard a great deal about antibiotics in the treatment of human diseases. You may be surprised to learn the extent to which they are being explored for possible use against plant diseases. Very recently (October, 1953) Doctor Carl W. Nichols of our bureau reviewed the literature on this subject and found no less than 58 publications on it, 47 of which were published in the last five years. Sixteen of the papers appeared during 1953, and the list already is out-of-date. The number of antibiotics was in excess of two dozen. In addition to those most commonly heard about such as penicillin, streptomycin, and aureomycin, there are such names as actidione, antimycin, terramycin, thiolutin, helixin, chrysoidin, citronin, gliotoxin, humulon, and others. To name them all here would be monotonous. Many have shown promise and some have given striking results in experiments. The pathogens on which they have been tried include bacteria, fungi, and viruses. Among the diseases for which positive results were obtained in more or less degree are fire blight (pear blight), walnut blight, halo blight of beans, crown gall, bacterial soft rot, apple scab, cherry leaf spot, covered smuts of barley, oats and wheat, Verticillium wilt of potato and tomato, and some of the damping off diseases. Results have been less promising to date in the virus diseases, but research should be continued on them. The antibiotics have been applied experimentally in sprays, in seed treatments, and sometimes by other methods.

Among the antibiotics we are now finding materials which can be absorbed by plants and translocated in them in such a way as to provide systemic protection. Not only do they give protection against initial infections, but they destroy infections already established. There is a residual effect which gives a degree of lasting protection or immunity. Most of our bactericidal and fungicidal sprays have been limited in their effects to surface protection of plant parts. Sometimes frequently

* Based on a talk given at the fall meeting of the California State Association of County Agricultural Commissioners at Sacramento, California, on December 2, 1953.

repeated sprays were necessary to maintain good coverage, especially in rapidly growing plants. Systemic medication long has been used in human medicine, and it has been sorely needed for plants. It provides possibilities for better control of such diseases as root rots, vascular infections, and perhaps virus diseases, for all of which our usual sprays have been ineffective.

Treatment of plant diseases by systemics, or internal medication, is referred to as chemotherapy. Materials for this purpose are not limited to antibiotics. Certain organic compounds have shown some chemotherapeutic value, such as benzothiazole and related compounds for Fusarium wilt of tomato; 8-hydroxyquinoline benzoate for Dutch elm disease and for a wilt disease of chrysanthemums and carnations in commercial greenhouses.

Recently calcium sulfamate was found to be effective against leaf rust and stem rust of wheat when applied as a spray. It produced a systemic effect, stopped the development of the rust fungus in the host tissues, reduced the viability of spores in open pustules at the time of spraying, and showed a limited ability to induce immunity in the plants against further infections. Heretofore, the control of plant rust fungi in small grains with fungicides has not been very satisfactory. The common approach to these pathogens has been to breed resistant varieties of the hosts. However, new forms or races of the rust fungus are constantly appearing, some of them highly virulent. They spread rapidly, attack the varieties which were resistant to previous forms, and quickly undo in a few seasons all the good work that years of persistent and careful breeding had accomplished. The approach to the problem through chemotherapy appears to hold considerable promise for control of some of our most baffling and devastating plant diseases.

Some of the plant growth regulators have been shown to induce resistance to disease in plants and may be adaptable to the chemotherapeutic approach. Even when not directly toxic to the pathogens against which they are used, they bring about increased resistance to disease by altering the metabolism of the host plant. Some of the organic compounds other than plant growth regulators which are very low in fungitoxicity but rather high in chemotherapeutic potency seem to function in the same way.

DISEASE CONTROL BY CONDITIONING THE HOST

Some excellent work has been done recently in California on disease control by conditioning the host in the case of gladiolus corms. Curing corms immediately after digging and before cleaning at a temperature of 95 degrees F. developed periderm or cork tissue and cuticle resistant to infection and checked the advance of pathogenic fungi into the tissues. Delay in the heat curing until the corms were in condition for stripping off the old corms and roots dissipated the initial advantage of the curing at 95 degrees F. Disease organisms penetrated the tissues of the new corms before cork was formed. A worker in Maryland found that the longer gladiolus corms were allowed to cure before cleaning, up to 30 days (which was the maximum in his experiment) the less severe was Fusarium rot. He found that corms receiving the heat treatment or curing prior to storage were much less severely rotted than were those treated with fungicides. Successful corm storage requires quick repair

of injuries received during harvest so that no unhealed tissues remain for the entry of infections. This is accomplished by curing at high temperatures immediately after digging. The process is somewhat similar to that of suberization of potato tuber seed pieces after cutting and before planting to prevent seed piece infection, except that in potatoes less time is required than for gladiolus corms and suberization is accomplished at ordinary temperatures.

PLANT PARASITIC NEMATODES

There is a recent review of the nematode problem in the May, 1953, issue of the magazine, *Farm Management* (Vol. 2, No. 6, pages 63 to 74) which is well worth your reading. There are also many recent and current technical papers. Investigators are currently identifying and reporting new occurrences of nematode situations, and some work is also being done on control. Nematodes present very difficult problems and it has been estimated that there are fewer than 25 full-time nematologists today in the United States. We are fortunate to have several of them in California, including one in our own Bureau of Plant Pathology in the Department, Doctor Winfield H. Hart. He is a very busy man. Appropriations by the California Legislature this year have made it possible for the university to increase very substantially its personnel for research on plant parasitic nematode problems. Such research is sorely needed.

Plant parasitic nematodes can be classified into two general groups according to their feeding habits and manner of living. One is the endoparasitic group. The other is the ectoparasitic group. The endoparasitic nematodes live most of their life cycle and do their feeding within the host tissues. An example is the root-knot nematode. The ectoparasitic nematodes live in the soil and feed on the plant roots largely from the outside. They are somewhat of the hit-and-run type. They do their feeding, cause the damage, and then leave. For this reason they are very elusive and hard to detect. Root injury may be found but the nematodes have disappeared into the soil. To find them the nematologist must examine the soil surrounding the damaged roots. In doing this he will find various kinds of soil-inhabiting nematodes, and must then find a way to determine which did the damage.

The ectoparasitic nematodes destroy root tips and deplete root systems. They include some of the most devastating species. There are several which, in the aggregate, cause serious damage to a wide range of host plants in southeastern United States. Among them are the sting nematode, the stubby root nematodes, the awl nematode and a so-called dagger nematode. We probably should not be surprised to find the ectoparasitic nematodes to be of more importance in California than we now know.

PLANT DISEASE VECTORS

Two very recent items on plant disease vectors are of interest. One has to do with occasional transmission of plant viruses through the eggs of their insect vectors, and the other is a report on an eriophyid mite as a plant virus vector. L. M. Black at the Brooklyn Botanic Garden has reported transmission of the wound tumor virus (*Aurcogenus magnivena* Black) in crimson clover plants (*Trifolium incar-*

natum L.) through the eggs of the leafhopper (*Agalliopsis novella* (Say)) in about 1.8 percent of cases. He also reported that the New Jersey potato yellow dwarf virus (*Aureogenus vastans* H. var. *agalliae* Black) in crimson clover plants was passed through eggs of the leafhopper (*Agallia constricta* Van Duzee) in about 0.8 percent of cases. Previously only two plant viruses, the rice stunt virus (*Fractilinea oryzae* Holmes) and the clover club-leaf virus (*Aureogenus clavifolium* Black) have been reported to pass through the eggs of their insect vectors. The passage of viruses through the eggs of their vectors is important in the epidemiology of the diseases in which it occurs and adds to the difficulties of any control program.

Slykhuis of Canada and North Dakota recently reported the transmission of wheat streak mosaic virus by an eriophyid mite (*Aceria tulipae* Keifer). This mite, named and described by H. H. Keifer of our Bureau of Entomology, is wind dispersed. Its discovery as a vector of the wheat streak mosaic virus has explained wind dispersal of the wheat streak mosaic disease. The virus can persist in the mites for several days and is retained through the molting periods, although there is no indication that it is carried through the mite eggs.

Several plant viruses appear to be retained or spread in soil. Hewitt in California has reported apparent retention in the soil of the virus of the yellow mosaic disease of grapevines. Cation in Michigan reported spread of peach rosette mosaic in soil from around diseased trees. McKinney and others have reported spread of wheat viruses in soil. Perhaps in these cases unknown vectors living in the soil or carried about in the soil are the real culprits.

OAK WILT

The oak wilt disease is now known to occur in approximately 18 midwest and eastern states. Many workers are investigating it. There were at least seven papers on oak wilt at the American Phytopathological Society meetings last September at Madison, Wisconsin. The life history of the fungus is very complex and there is hardly time for a discussion of it here, other than to say that at least two kinds of spores are produced. Their role in the spread of the disease is being investigated. Local spread is known to take place through natural root grafts and through this means pockets of infection develop in the more densely wooded oak forests. However, long distance natural spread is not yet well explained. Insects, rodents, and birds have been suspected. Norris in Iowa has shown that certain species of Nitidulid beetles (Nididulidae) when exposed to oak wilt inoculum and transferred to wounded, healthy trees are capable of carrying a sufficient load of the fungus inoculum to infect a tree through a fresh wound within three weeks. There is some indication that long distance dissemination of the disease occurs through a mechanical transfer of the fungus to fresh wounds in healthy living trees. A study of isolated wilting oak trees in Iowa showed an almost universal presence of fresh wounds of one sort or another in them through which the infection may have entered as a result of insect spread. Other workers in West Virginia also have studied Nitidulid beetles and experimentally inoculated oak trees by means of insects either naturally or artificially contaminated with spores of the oak fungus. Bart and Griswold in Ohio found numerous

endospores of the oak wilt fungus in the excrement of fruit flies (*Drosophila melanogaster* Meig.) which fed upon the fungus and they reproduced the disease with cultures made from the excrement. They also found the excrement from certain unidentified species of Nitidulidae to contain large numbers of endoconidia, but they had not yet determined the viability of the spores at the time of their report. There is evidence that the oak wilt fungus does not usually survive long in oak trees killed by it. Studies on lumber and other wood products from diseased oak trees have indicated that the fungus is relatively short-lived in dead oak wood. The fungus was still viable in roots of infected oak trees after nine months from when the trees were cut. Caution is needed in drawing hasty conclusions as to the hazards of spread by movement of oak wood and wood products until further studies can be completed. However, there has been considerable promise shown in efforts to prevent local spread of oak wilt by killing the trees adjacent to and in the immediate periphery of infected trees. Dead oak trees appear to block spread. Some therapeutic effect has been obtained by foliage and soil applications of certain chemicals to infected oak trees. In some experiments with young oak trees, recovery of 75 percent of infected trees was obtained by Hoffman in Illinois, although the oak wilt fungus was reisolated from recovered trees. Apparently they had been rendered tolerant to the disease by the treatments but were not freed from the infection.

TRISTEZA AND QUICK DECLINE

As research on tristeza and quick decline continues, it becomes increasingly apparent that quick decline is a form of tristeza. In some parts of the world other names are used for what must be essentially the same disease, which appears to have made its way from its apparent beginning in South Africa many years ago to various parts of the world. California seems to have been the first place where it was recognized in North America.

There have been authoritative reports of a similar disease in Louisiana where I understand transmission tests were started to make a conclusive determination, but I do not have the results of the tests.

Positive experimental evidence of the occurrence of the disease in Florida has now been reported by transmission tests completed there. Reports indicate that the disease has become widespread in the orange growing areas in Florida where field symptoms have been observed on varieties of sweet orange growing on sour orange root stock. The form of the disease in Florida appears to have been so mild that the virus became widely dispersed there before its identity could be recognized.

In California we seem to have more severe forms of the disease than in Florida but not such severe forms as in South America. State-wide surveys here by state and county personnel indicate that so far as natural spread is concerned the disease may be approaching certain ecological limits closely related to the population density and distribution of its insect vector. The disease in California has not been found outside of Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura Counties.

BROOMRAPE

Broomrape, *Orobanche ramosa* L., previously found on tomatoes in Alameda County, is now known to be present there on several weed hosts in infested tomato fields according to R. D. Durbin of the University of California. He has reported it on pigweed, *Amaranthus retroflexus* L., shepherdspurse, *Capsella bursa-pastoris* (L.) Medic., hairy nightshade, *Solanum sarachoides* Sendt., poison hemlock, *Conium maculatum* L. and spiny clotbur, *Xanthium spinosum* L. The pigweed, shepherdspurse and hairy nightshade are new hosts not previously reported for this parasite. Surveys this year by state and county personnel included 30 tomato plantings other than the 12 fields in the county that were reported infested last year. The parasite was found this year in two additional fields. They were in areas that had been flooded and it continues to appear as if spread has been brought about largely through flood waters which have carried the broomrape seed and distributed it over the area. There are now 14 known infested fields.

ANGULAR LEAF SPOT OF COTTON

In our annual report for 1951 we reported the occurrence of the angular leaf spot or bacterial blight disease of cotton, caused by *Xanthomonas malvacearum* (E. F. Sm.) Dows., in a field in Fresno County which had been overhead irrigated. This disease is rare in California, and had been observed previously at Bard in 1912 and at Shafter in 1929. This year several fields in Fresno County which had received overhead irrigation were infected and in some instances damage was rather severe. Surveys for the disease have been made to date this year in Merced, Madera, Fresno, Kings, Kern and Tulare Counties. The disease was found in 24 fields of which one was in Madera County, 15 were in Fresno County, 6 were in Kern County and 2 were in Tulare County. It was found only in fields irrigated by overhead sprinkling. Field examinations were made in 237 cotton fields in the six counties mentioned above and 80 of them had received overhead irrigation. The disease was not found in any of the furrow irrigated fields although it is possible that seed borne infections occurred in some of the furrow irrigated fields early in the season but were suppressed with the onset of hot dry weather. In addition to the field examinations, inspections were made of 26,200 cotton bolls collected in Fresno and Kings Counties during pink bollworm surveys. These came from about 492 fields. The disease was found in the bolls from four of these fields but the same four fields had been found infected during the field examinations. There are indications that the disease is being moved about with infected cotton seed. Efforts are being made to prevent the use of cotton seed from infected fields for planting purposes. Apparently this disease has been with us in some degree but has been suppressed by our hot dry climate during the growing season except where overhead watering has brought about conditions favorable for its development. Angular leaf spot occurs in most cotton growing areas where summer rains provide the moisture necessary for its development and in such areas it frequently causes serious damage to the leaves, bolls, branches and stems of the cotton plant.

PEACH YELLOW LEAF ROLL

Tree-by-tree orchard inspections of peach trees for yellow leaf roll have now been made in all commercial peach growing areas north of the Tehachapi mountains except for approximately 2,500 acres in Stanislaus County which are to be inspected next year. No cases of the disease have been found outside of the peach bowl area of Butte, Placer, Sutter and Yuba Counties. This year there were 463 new tree cases of yellow leaf roll found on 167 infected properties in the four counties. This is a considerable reduction in diseased trees compared to the 1,008 found last year, the 1,029 found in 1951 and the 877 found in 1950. However, 155 of the diseased trees were found on 105 newly infected properties this year. Altogether there have been 230 infected properties found over the four year period 1950 to 1953 inclusive. The reduction in the number of diseased trees this year to approximately 46 percent of the number found last year is encouraging but we are somewhat concerned with the number of newly infected properties. On the other hand, inspections this year showed no disease on 63 of the 125 properties found infected prior to this year. The entomologists who have made some vector population studies in the field have told us that the insect vectors were very scarce in 1952 and apparently that situation helped to reduce the number of diseased trees which became infected last year and were among those found this year. This is a break in our favor in the suppression of the disease.

STONE FRUIT VIRUSES

The work on stone fruit viruses is continuing with a large number of workers throughout the United States who have coordinated themselves on a regional and national basis to a degree not often found among research workers. Probably all of you have seen the stone fruit virus handbook published by the United States Department of Agriculture as Agriculture Handbook 10, which came off the press about two years ago. It was the product of the combined efforts of many people, and it contains a good summary of the information on stone fruit viruses up to the date of its publication in 1951. More new diseases have been found since then and investigations are continuing.

Considerable emphasis is being placed on nursery stock improvement programs in various states from the view point of virus free nursery stock and propagating materials. In California we are continuing the work in our bureau on the development of methodology for certification that fruit, nut tree and vine nursery stocks are virus free. Nurserymen are showing increased interest in the program and very good cooperation.

PREVENTING THE IMPORTATION OF NEW DISEASES

The recent increase in our knowledge of virus diseases has made us more cognizant of the need for better methods of preventing the importation of new virus diseases in imported propagating stock. Visual inspection methods alone are not sufficient. Grape stocks now coming into the State are being indexed by transmission tests to determine their freedom from virus diseases before release to growers. This work is

being done at the University of California at Davis under federal and state supervision and in cooperation with the university and the grape industry. Similar procedures are now being worked out for imported citrus stock. It is planned that the indexing will be done at Riverside in an insect proof greenhouse after a preliminary quarantine detention period at Glen Dale, Maryland with visual inspection and observation for any diseases that might be recognized before the stock comes to California. Index tests at Riverside will be made on our commercial citrus variety and rootstock combinations to determine whether any serious virus diseases are present. After index tests have shown the stock to be free of serious diseases it can be released to growers for planting. We hope by this means to avoid importing new serious virus diseases.

EVALUATION OF FIELD RUN SEED

MARTIN SUSKIN
Research Marketing Project
California Department of Agriculture

INTRODUCTION

During 1948 a project was initiated by the California State Department of Agriculture through the Production Marketing Administration program of "Technical Assistance in Marketing Practices Pertinent to Agricultural Seed" to study the methods of evaluating the actual market value of field run seed by laboratory tests. The scope of this project is to determine whether or not it is possible to obtain a method of making just settlements between growers and buyers on the basis of field run seed samples.

The method used in this study is to draw representative samples of field run seed and test them for purity and germination. The sample is cleaned by standard practices on laboratory models of standard seed cleaning mills. Purity and germination tests are made on all separations in the cleaning process. An analysis is made by comparing the laboratory analysis of purity x germination percentages of the field run seed sample with the P. L. S. obtained by milling.

We would like to thank the seed growers, seed companies, agricultural commissioners and other interested persons and groups for their interest and cooperation in carrying out this project.

Sampling Procedures

Sampling of field run seed started with the 1948 crop season and continued through the 1951 crop year. The samples were drawn from representative areas throughout the State and consisted of the following:

Ladino clover (*Trifolium repens*)	70
Alfalfa (*Medicago sativa*)	47
Carrot (*Daucus carota*)	18
Beet (*Beta vulgaris*)	14
Lettuce (*Lactuca sativa*)	9
Onion (*Allium cepa*)	2

The drawing of field run samples was accomplished by three methods: (1) A sack was hung on the combine during the harvesting and small samples were added to the sack as the harvesting proceeded. After completion of harvest the composite sample was thoroughly mixed and divided to a workable size. (2) The samples were drawn from closed sacks prior to milling with various triers or opened and sampled by hand, depending on the variety of seed, cleanout, etc. Bulk samples of alfalfa were sampled by hand and with a 30-inch trier. (3) A composite sample was also drawn by hand from the field run seed as it was being fed into the elevators leading to the cleaning mills.

Testing and Milling of Seed

The field run sample was thoroughly mixed, and a representative portion sent to the Federal-State Seed Laboratory for a noxious-weed examination, purity analysis, and germination test. This information was recorded on a master data sheet, each sample having its own master data sheet and number. The sample was next weighed to the closest tenth gram and milled, using standard cleaning practices. Milling equipment consisted of laboratory scale models of standard seed cleaning equipment, established in Sacramento, California. The following mills were used in the cleaning operations: air screen cleaner, dodder mill, draper, stoner mill, indent mill (for Ladino clover) and hand screens. The sample was protected from contamination during milling as far as possible. The various separations from the cleaning processes were then weighed and sent to the seed laboratory for purity analysis and germination test. The "Rules for Testing Seeds Adopted by the Association of Official Seed Analysts" were adhered to as far as practical in making all the tests. The weights of these separations were added up and checked against the in-weight of the field run seed sample to determine the amount of cleaning loss.

Definitions of Terms and Abbreviations

P—Purity analysis of the sample expressed in percent by weight.

G—Percent of germination based on four replications of 100 seed from purity separations.

P.S.—Pure seed is the end product of seed cleaning or the pure seed remaining after the inert matter, other crop seed and weed seed have been removed as near as practicable by cleaning mills.

Septs. Separations, meaning the various separations made in the milling of a lot of field run seed.

S—Summation

P.L.S.—Pure live seed, the actual worth of a lot of seed. The purity times the germination of the particular lot, P.S., or Sept. divided by 100.

In-wt. blk.—The initial weight of the field run seed sample in grams, prior to milling.

% P.L.S. Lab. Analysis on the field run seed sample—Is the P $\times$ G $\times$ in-wt. blk. of field run seed sample, divided by the in-wt. blk. of the field run seed $\times$ 100. This figure is expressed as a percentage.

% P.L.S. Milled Analysis—P $\times$ G $\times$ wt. P.S. divided by in-wt. blk. of field run seed $\times$ 100. This figure is also expressed as a percentage.

% P.L.S. S Septs.—Is the summation of P $\times$ G $\times$ separations divided by the in-wt. blk. of the field run seed $\times$ 100. Expressed in percent.

Mean or arithmetic average is the sum of the differences divided by their number.

Diff.—Difference, is the % P.L.S. Lab. analysis of the field run seed sample minus % P.L.S. Milled cleanout analysis or % P.L.S. S Septs.

Vegetable Seed

In Table 1, comparing Column 1 and Column 2 for the carrot and lettuce samples, are some wide limits between P.L.S. laboratory analysis and P.L.S. milled analysis. These wide limits are noticeable in Column

3. The factors causing these wide limits between laboratory procedures and the laboratory milling are:

(1) Difficulty in dividing a chaffy sample down to a small enough representative sample for purity tests, i.e., field run carrot and lettuce seed.

(2) Impurities—Type, weight and character of inert materials, weed seed content, and other crop seed, i.e., Buckhorn (*Plantago* spp.) in alfalfa, tickle grass (*Panicum* sp.) in Ladino clover.

(3) Character of seed being milled, whether it has a high percentage of light, small, large or damaged seed. A certain amount of this seed will be taken out in cleaning, yet it is seed that is counted as pure in the P.L.S. in the laboratory analysis of field run seed and usually it will germinate fairly well.

(4) Errors in milling, improper management of milling operations such as too heavy air blow, bottom screens too large, or top screen too small.

The mean difference for all vegetable seed samples in Column 3 is positive 8.5. The extremes are negative 3.8 to positive 32.5. A negative difference indicates that more P.L.S. was found in the final milled product than by laboratory analysis on the field run seed samples.

Column 4 is a check and is a summation of all P.L.S. contained in all separations made during milling. Column 5 is the difference between P.L.S. laboratory analysis and P.L.S. S. Septs. This difference theoretically should be 0, since the P.L.S. found in the field run sample prior to milling should be found by adding up the P.L.S. content of the final product plus the discards. The mean difference for Column 5 is a negative 1.0. The extremes are negative 24.1 to a positive 9.6.

To be of value laboratory procedures should come within a certain allowable tolerance or percentage to the actual P.L.S. found in the sample by milling. Using an arbitrary tolerance of plus or minus 5 and 10 percent for the vegetable seed samples we have 41.9 percent within a 5 percent tolerance. For 10 percent we have 27 samples or 62.8 percent of the samples within tolerance.

Small Seeded Legumes

In Table 1, comparing the P.L.S. laboratory analysis and P.L.S. milled analysis, the close affinity of these percentages is apparent for the alfalfa and Ladino clover samples. The mean average for the differences in Column 3 for small seeded legumes is positive 3.4. The extremes are negative 10.0 to positive 16.3.

Column 4 again is a check and accounts for all P.L.S. contained in all the sepatations made during milling of the sample. The mean difference for the small seeded legumes is a negative 0.5. The extremes are a negative 11.8 to positive 10.5.

Applying a plus or minus 5 and 10 percent tolerance to the difference between laboratory analysis P.L.S. and milled analysis P.L.S., we have 68 samples or 58.1 percent within a 5 percent tolerance. For 10 percent we have 117 samples or 94.9 percent of the samples within tolerance.

TABLE 1

Shows the Calculated Percentages of P.L.S. Found by Laboratory Procedures, Milling, and Summation of P.L.S. for Each Individual Sample

Number	Crop Seed	(1) % P.L.S. Lab. anal.	(2) % P.L.S. milled anal.	(3) 1—2 Diff.	(4) % P.L.S. S. Septs.	(5) 1—4 Diff.
RM5	Carrot	41.7	39.6	2.1	50.7	—9.0
RM6	Carrot	53.8	51.1	2.7	57.1	—3.3
RM41	Carrot	54.9	41.3	13.6	54.2	0.7
RM43	Carrot	56.3	39.1	17.2	52.2	4.1
RM44	Carrot	70.2	60.1	10.1	69.9	0.3
RM45	Carrot	74.6	63.6	11.0	71.4	3.2
RM50	Carrot	67.8	57.0	10.8	68.2	—0.4
RM51	Carrot	47.4	42.9	4.5	50.9	—3.4
RM84	Carrot	49.2	45.7	3.5	69.5	—20.3
RM86	Carrot	56.4	46.8	9.6	53.4	3.0
RM87	Carrot	54.1	51.0	3.1	53.9	0.2
RM88	Carrot	38.3	29.3	9.0	62.4	—24.1
RM146	Carrot	55.7	42.9	12.8	55.1	0.6
RM147	Carrot	62.7	45.2	17.5	61.4	1.3
RM148	Carrot	55.0	33.7	21.3	51.2	3.8
RM150	Carrot	60.0	37.1	22.9	59.8	0.2
RM169	Carrot	71.4	52.3	19.1	70.0	1.4
RM170	Carrot	67.7	50.7	17.0	67.1	0.6
RM1	Beet	38.2	36.4	1.8	37.9	0.3
RM30	Beet	64.6	67.0	—2.4	67.5	—3.9
RM31	Beet	79.1	74.6	4.5	75.4	3.7
RM34	Beet	81.6	77.0	4.6	81.0	0.6
RM35	Beet	70.8	68.1	2.7	72.0	—1.2
RM36	Beet	77.5	72.0	5.5	75.8	1.7
RM77	Beet	39.6	41.8	—2.2	43.8	—4.2
RM78	Beet	74.9	64.9	10.0	66.0	8.9
RM79	Beet	78.3	77.3	1.0	79.9	—1.6
RM80	Beet	66.8	60.9	5.9	64.8	2.0
RM83	Beet	66.6	66.8	—0.2	69.5	—2.9
RM117	Beet	71.3	68.1	3.2	73.4	—2.1
RM118	Beet	43.0	46.8	—3.8	49.2	—6.2
RM119	Beet	70.0	62.7	7.3	69.1	0.9
RM4	Lettuce	43.1	39.8	3.3	43.7	—0.6
RM39	Lettuce	41.1	20.0	21.1	35.1	6.0
RM40	Lettuce	46.7	34.3	12.4	55.6	—9.9
RM42	Lettuce	58.9	26.4	32.5	49.3	9.6
RM85	Lettuce	41.8	32.2	9.6	41.8	0.0
RM100	Lettuce	82.3	77.0	5.3	82.9	—0.6
RM149	Lettuce	25.3	14.4	10.9	29.6	—4.3
RM171	Lettuce	55.8	42.8	13.0	52.8	3.0
RM172	Lettuce	36.4	26.8	9.6	35.0	1.4
RM152	Onion	62.4	59.2	3.2	61.0	1.4
RM153	Onion	48.2	47.5	0.7	54.1	—5.9
RM3	Alfalfa	70.4	75.7	—5.3	78.3	—7.9
RM7	Alfalfa	38.1	48.1	—10.0	49.9	—11.8
RM8	Alfalfa	80.8	80.4	0.4	83.2	—2.4
RM18	Alfalfa	72.0	68.1	3.9	71.8	0.2
RM29	Alfalfa	66.5	56.1	10.4	62.9	3.6
RM37	Alfalfa	83.0	77.9	5.1	79.9	3.1
RM38	Alfalfa	68.8	64.9	3.9	66.4	2.4
RM46	Alfalfa	76.2	76.5	—0.3	78.0	—1.8

TABLE 1—Continued

Shows the Calculated Percentages of P.L.S. Found by Laboratory Procedures Milling, and Summation of P.L.S. for Each Individual Sample

Number	Crop Seed	(1) % P.L.S. Lab. anal.	(2) % P.L.S. milled anal.	(3) 1—2 Diff.	(4) % P.L.S. S. Septs.	(5) 1—4 Diff.
RM47	Alfalfa	91.7	85.6	6.1	87.1	4.6
RM48	Alfalfa	77.5	78.6	—1.1	79.3	—1.8
RM49	Alfalfa	88.9	89.7	—0.8	91.2	—2.3
RM52	Alfalfa	74.7	73.5	1.2	77.0	—2.3
RM53	Alfalfa	72.8	69.1	3.7	70.7	2.1
RM54	Alfalfa	81.5	82.7	—1.2	85.4	—3.9
RM55	Alfalfa	82.8	81.1	1.7	83.2	—0.4
RM56	Alfalfa	82.1	78.8	3.3	82.2	—0.1
RM81	Alfalfa	77.1	71.0	6.1	74.2	2.9
RM89	Alfalfa	91.6	86.9	4.7	90.00	1.6
RM90	Alfalfa	79.4	84.8	—6.4	87.8	—8.4
RM91	Alfalfa	88.9	83.8	5.1	90.6	—1.7
RM92	Alfalfa	76.3	71.2	5.1	75.2	1.1
RM93	Alfalfa	78.7	79.4	—0.7	81.9	—3.2
RM94	Alfalfa	60.6	58.6	2.0	60.1	0.5
RM95	Alfalfa	94.0	86.4	7.6	86.8	7.2
RM96	Alfalfa	71.4	76.8	—5.4	79.9	—8.5
RM97	Alfalfa	78.5	72.9	5.6	75.0	3.5
RM68	Alfalfa	89.7	90.2	—0.5	91.6	—1.9
RM98	Alfalfa	88.9	85.5	3.4	89.5	—0.6
RM101	Alfalfa	85.8	80.1	5.7	86.5	—0.7
RM102	Alfalfa	83.9	79.8	4.1	85.5	—1.6
RM122	Alfalfa	90.4	89.6	0.8	91.2	—0.8
RM154	Alfalfa	69.6	60.2	9.4	66.9	2.7
RM155	Alfalfa	89.9	83.1	6.8	87.9	2.0
RM156	Alfalfa	76.2	66.8	9.4	74.3	1.9
RM157	Alfalfa	85.3	81.8	3.5	87.0	—1.7
RM158	Alfalfa	89.2	82.2	7.0	88.00	1.2
RM159	Alfalfa	75.0	70.1*	4.9	75.8	—0.8
RM160	Alfalfa	82.0	75.0*	7.0	83.4	—1.4
RM161	Alfalfa	85.00	85.1*	—0.1	89.7	—4.7
RM162	Alfalfa	79.4	72.3	7.1	79.3	0.1
RM163	Alfalfa	44.5	40.2*	4.3	46.00	—1.5
RM164	Alfalfa	90.7	74.4*	16.3	80.2	10.5
RM165	Alfalfa	74.8	72.4*	2.4	79.0	—4.2
RM166	Alfalfa	84.0	78.1	5.9	87.7	—3.7
RM167	Alfalfa	63.0	59.3	3.7	67.6	—4.6
RM168	Alfalfa	82.4	74.6	7.8	83.0	—0.6
RM173	Alfalfa	87.0	85.1	1.9	89.0	—2.0
RM2	Ladino clover	86.4	80.1	6.3	86.7	—0.3
RM9	Ladino clover	10.1	8.8	1.3	10.0	0.1
RM10	Ladino clover	7.1	6.6	0.5	7.8	—0.7
RM11	Ladino clover	23.6	19.1	4.5	20.4	3.2
RM12	Ladino clover	21.2	23.6	—2.4	25.4	—4.2
RM13	Ladino clover	16.3	14.0	2.3	15.7	0.6
RM14	Ladino clover	13.3	10.3	3.3	11.7	2.6
RM15	Ladino clover	21.0	16.3	4.7	18.5	2.5
RM16	Ladino clover	22.6	23.4	—0.8	25.0	—3.4
RM17	Ladino clover	16.6	14.3	2.3	16.2	0.4
RM19	Ladino clover	23.0	16.0	7.0	18.1	4.9
RM20	Ladino clover	10.1	10.1	0.0	11.6	—1.5
RM22	Ladino clover	35.7	27.7	8.0	30.3	5.4

* Two grades of alfalfa seed.

TABLE 1—Continued

Shows the Calculated Percentages of P.L.S. Found by Laboratory Procedures, Milling, and Summation of P.L.S. for Each Individual Sample

Number	Crop Seed	(1) % P.L.S. Lab. anal.	(2) % P.L.S. milled anal.	(3) 1—2 Diff.	(4) % P.L.S. S. Septs.	(5) 1—4 Diff.
RM23	Ladino clover	16.6	17.7	—1.1	19.5	—2.9
RM24	Ladino clover	45.1	37.2	7.9	40.6	4.5
RM25	Ladino clover	34.6	37.1	2.5	39.6	—5.0
RM27	Ladino clover	25.3	19.4	5.9	21.1	4.2
RM57	Ladino clover	35.5	33.3	2.2	36.1	—0.6
RM58	Ladino clover	49.6	46.2	3.4	48.5	1.1
RM59	Ladino clover	3.7	3.2	0.5	3.5	0.2
RM60	Ladino clover	21.5	21.6	—0.1	23.1	—1.6
RM61	Ladino clover	37.3	39.0	—1.7	40.7	—3.4
RM62	Ladino clover	31.4	36.7	—5.3	39.4	—8.0
RM63	Ladino clover	4.3	6.4	—2.1	8.9	—4.6
RM64	Ladino clover	73.1	67.7	5.4	70.3	2.8
RM65	Ladino clover	13.2	10.2	3.0	11.6	1.6
RM66	Ladino clover	20.8	17.0	3.8	19.2	1.6
RM67	Ladino clover	8.7	7.6	1.1	8.5	0.2
RM69	Ladino clover	66.0	62.0	4.0	63.9	2.1
RM70	Ladino clover	37.5	29.2	8.3	32.9	4.6
RM71	Ladino clover	23.6	19.0	4.6	23.6	0.0
RM73	Ladino clover	8.9	8.6	0.3	9.8	—0.9
RM75	Ladino clover	18.4	16.4	2.0	18.00	0.4
RM76	Ladino clover	28.5	30.6	—2.1	33.3	—4.8
RM103	Ladino clover	18.9	19.0	—0.1	23.8	—4.9
RM104	Ladino clover	50.3	41.5	8.8	45.8	4.5
RM105	Ladino clover	28.4	21.6	6.8	27.2	1.2
RM106	Ladino clover	31.8	33.6	—1.8	38.3	—6.5
RM107	Ladino clover	49.9	38.8	11.1	42.8	7.1
RM108	Ladino clover	58.7	53.6	5.1	62.2	—3.5
RM109	Ladino clover	9.1	9.7	—0.6	13.3	—4.2
RM110	Ladino clover	20.0	23.7	—3.7	27.4	—7.4
RM111	Ladino clover	42.2	39.6	2.6	46.5	—4.3
RM112	Ladino clover	38.2	37.0	1.2	41.1	—2.9
RM113	Ladino clover	43.9	43.5	0.4	47.0	—3.1
RM114	Ladino clover	55.9	53.0	2.9	57.4	—1.5
RM115	Ladino clover	18.3	16.1	2.2	17.3	1.0
RM123	Ladino clover	83.6	71.8	11.8	80.6	3.0
RM124	Ladino clover	28.0	23.4	4.6	28.0	0.0
RM125	Ladino clover	19.0	17.1	1.9	23.2	—4.2
RM126	Ladino clover	23.2	12.8	10.4	15.9	7.3
RM127	Ladino clover	11.7	10.9	0.8	13.1	—2.4
RM128	Ladino clover	25.0	22.9	2.1	26.7	—1.7
RM129	Ladino clover	18.9	9.6	9.3	11.3	7.6
RM130	Ladino clover	83.7	76.4	7.3	79.6	4.1
RM131	Ladino clover	82.9	76.5	6.4	81.6	1.3
RM132	Ladino clover	69.7	63.2	6.5	69.8	—0.1
RM133	Ladino clover	83.7	76.2	7.5	83.8	—0.1
RM134	Ladino clover	92.8	78.4	14.4	86.2	6.6
RM135	Ladino clover	55.8	50.1	5.7	59.8	—4.0
RM136	Ladino clover	29.7	27.8	1.9	34.9	—5.2
RM137	Ladino clover	26.9	19.9	7.0	25.5	1.4
RM138	Ladino clover	81.0	78.6	2.4	82.8	—1.8
RM139	Ladino clover	38.1	31.8	6.3	35.0	3.1
RM140	Ladino clover	23.5	17.2	6.3	19.3	4.2
RM141	Ladino clover	82.6	76.4	6.2	88.4	—5.8
RM142	Ladino clover	66.1	64.4	1.7	69.2	—3.1
RM143	Ladino clover	74.5	67.0	7.5	68.5	6.0
RM144	Ladino clover	41.6	38.0	3.6	39.3	2.3
RM145	Ladino clover	53.2	61.2	—8.0	64.9	—11.7

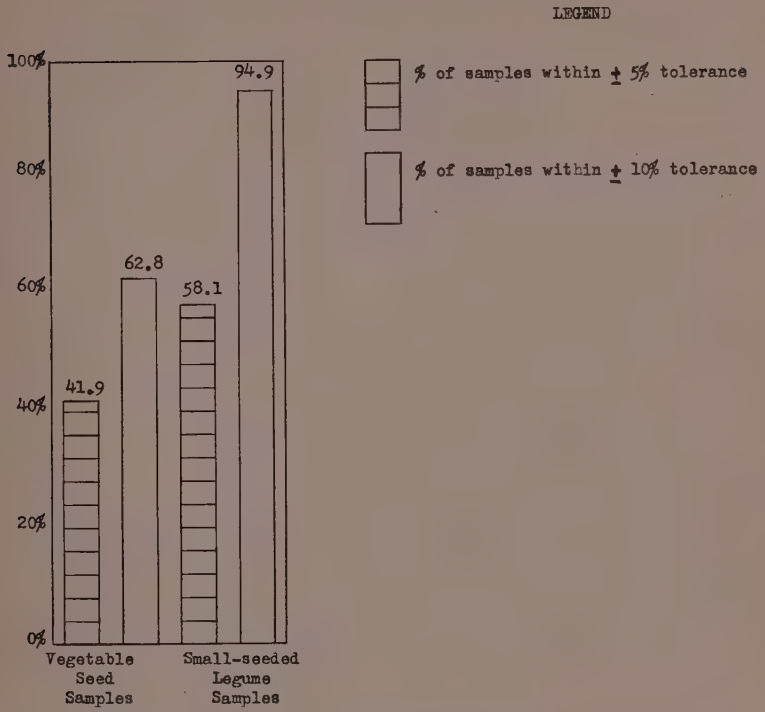

FIGURE 1. Shows the percentages of samples within a plus or minus 5% and 10% tolerance

CONCLUSIONS

The objective of this project is to determine whether or not laboratory analysis of field run seed is of practical value in arriving at the actual value of field run seed to the satisfaction of both grower and buyer. To be of value laboratory procedures should come within a specified allowable tolerance to the actual amount of cleaned seed. Thus, applying a plus or minus 5 percent tolerance, 41.9 percent and 58.1 percent respectively of the vegetable and small seeded legumes fall within the tolerance (Figure 1). Due to the following factors that cause more than a 5 percent plus or minus difference between the percent P.L.S. laboratory analysis of the field run seed and the percent P.L.S. milled analysis it appears impractical to evaluate field run seed by this method:

1. Difficulty in dividing a chaffy sample down to a small enough representative sample for purity test.

2. The type, weight and character of inert materials, variety and number of weed seed and other crop seed.

3. The character of seed being milled, whether the seed has a percentage of light, small, large or damaged seed. A certain amount of this seed will be removed in cleaning, yet it is counted as pure in the

laboratory analysis of the field run sample and usually will germinate fairly well.

4. Economic value of the seed in question.

Other Uses of Laboratory Procedures

In Figure 1, 94.9 percent of the small seeded legumes are within a plus or minus 10 percent tolerance. It then appears that laboratory procedures as a rough check and as a rough check only, may be of value in estimating the worth of a lot of field run alfalfa or Ladino clover seeds, taking into consideration the following factors that directly affect laboratory procedures:

(1) Representativeness of the sample for testing.

(2) Type, weight and character of inert material, variety and number of weed seeds and other crop seeds.

(3) The character of seed being milled, whether the lot contains percentage of light, small, large or damaged seed.

(4) Economic value of the seed.

This rough check could not be applied to chaffy vegetable field run seed but may be of use in field run beet seed. In Table 1, Column 3, 100 percent of the beet samples are within a plus or minus 10 percent tolerance.

Laboratory procedures may be used to predict the number of pounds of that seed grown for a particular crop year before the cleaning is completed on that crop seed. This appears to be of use only in small-seeded legumes, and maybe beet seed.

The mean average for the differences between laboratory analysis P.L.S. and milled analysis P.L.S. is 3.4 for the small seeded legume seed.

SUMMARY

The prime motive of this study is the evaluation of laboratory procedures in obtaining the actual market value of field run seed crops to the satisfaction of both grower and buyer. To attain this goal, 160 samples of various kinds of field run seed samples were drawn, tested for purity and germination and then milled. A comparison was then conducted on the basis of percent of P.L.S. found by laboratory methods and milling. To be of value for laboratory analysis a definite tolerance should be allowed on the P.L.S. found by laboratory purity and germination tests. Using an arbitrary plus or minus 5 percent tolerance, less than 50 percent of the vegetable samples and only 58.1 percent of the small seeded legumes are within the tolerance. Thus, to reach an accurate and true picture of the value of the seed crop in question it would not be practical to evaluate field run seed by seed laboratory procedures.

CURRENT INSECT NOTES

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Since the last report made September, 1953, two insect species and one mite of economic importance have been reported which are new to California and the occurrence of nine species of similar importance, previously reported but of limited distribution in the State, have been recorded in new areas.

Khapra beetle, *Trogoderma granarium:* This dermestid was found on December 7th by B. F. Alexander, regional representative of the Production Marketing Administration, U.S.D.A. to be heavily infesting bulk stored barley held in warehouses in Angiola and Alpaugh in Tulare County. Its presence was reported to the department by J. E. Swift, Extension Entomologist, University of California. This represented not only its first recorded occurrence in California, but in the western hemisphere as well. Subsequent survey has shown it to be present also in Madera, Fresno, Kern, Los Angeles, Riverside and Imperial Counties. A review of these findings definitely shows it to have been present in Fresno warehouses as early as 1946 and that it was unknowingly transported to the two houses in Tulare County through the medium of used sacks. No evidence has been developed to indicate how it might have gained entrance to or spread within the State other than the instance cited.

Failure to observe its presence sooner seems to be closely associated with its similarity to other species of dermestids of noneconomic importance, commonly found around stored grains. Other species are restricted in their feeding to animal matter but this species has a history of major importance as a pest of a wide range of stored agricultural products having a high protein content. These include all of the grains, rice, flax, beans, peanuts, pistachio, and many others. It has been found infesting wheat flour and associated with dried buttermilk.

The tiny adult, typical dermestid beetles, are very short lived and do little if any feeding. The larvae, however, can live under seemingly very adverse conditions for as long as three years. The species is very prolific and the larvae highly gregarious. They occur in masses particularly in the surface areas of stored grains but may be found scattered throughout the mass. Optimum temperatures for the larvae are around 85 degrees to 90 degrees F. which they help create due to their massing. The immature larvae seem restricted in their feeding to broken kernels. The mature larvae destroy whole grain, the host material being reduced to the consistency of powder. They also seem able to survive unusually low humidity. These factors make them a more serious pest in warmer and drier climates and seem to depreciate any possibility of field infestation.

This species is apparently the major pest of grains in the eastern hemisphere, particularly of wheat, and promises similar importance

here. When found, it was already too widespread to permit any attempt at eradication. However, agricultural commissioners in the counties concerned are making a concerted effort to impress owners and operators of infested premises with its seriousness to the extent of carrying out intensive control measures. The department is giving considerable time to developing and improving effective controls.

Scurfy scale, *Chionaspis furfura:* This diaspid scale was reported December 17th, by County Agricultural Inspector G. W. Schwegel as infesting birch trees on the growing grounds of a nursery in San Diego. Extremely light infestation was found on a single tree in a block brought in from Tennessee some time previously. At that time the infestation must have been so light as to defy detection.

Unfortunately, some of the trees had been sold locally with no record of owner, and it is possible that one or more of these may carry infestation which cannot be recorded until detected by survey. However, the initial infestation was so light that this possibility is being depreciated. The remaining trees in the nursery were destroyed by the owner.

This scale occurs more or less generally east of the Continental Divide where it is recorded as an important pest of apple, pear, quince, cherry and certain berries and also is common to related wild hosts.

This is the second record for California, a similar situation being reported in Fresno County in 1939 when the infested hosts were reported to have been destroyed by the owner. Other earlier reports of its occurrence on wild and cultivated hosts in California have all been checked and found to have been confused with other species.

A mite, *Tarsonemus* sp.: As yet not specifically identified, this mite was first reported on August 26th, as having been taken by County Agricultural Inspector L. C. Johnson, on *Maranta leuconeura kerchoveana* in a Los Angeles nursery. On September 4th, it was also taken by D. H. Byers, Entomologist, Agricultural Commissioner's office, on the same host in a nursery at Buena Park, Orange County. These two instances represent the first recorded presence of this mite in California. It has now been determined as the cause of injury to Maranta which has been puzzling nurserymen for some time. Control is considered a local matter.

The pear psylla, *Psylla pyricola:* First recorded in California in Siskiyou County on May 4, 1953, and later at Hilt in the same county and at Crescent City in Del Norte County as previously reported. Its presence was definitely due to natural spread from the north in Oregon. More recently infestation has been recorded at Klamath Glen, 25 miles south of Crescent City on August 3d by L. J. Garrett, County Agricultural Commissioner, and at Orick, Humboldt County on August 6th by Warren L. Fisher, State Plant Quarantine Inspector at Smith River. Due to this rapid natural spread even from light undetectable infestations, and failure of a previous well organized attempt at eradication in Washington State by federal authorities, no such attempt is contemplated here. The southward spread, however, is being closely watched and reported to commissioners and growers as found to permit immediate application of control measures.

The Egyptian alfalfa weevil, *Hypera brunneipennis:* This weevil made its appearance in San Bernardino County, specimens having been

submitted for identification by County Agricultural Inspector G. Harper on February 17, 1954, from Chino. It was collected in association with alfalfa. Previously reported occurrences have included Imperial, San Diego, Los Angeles, Riverside and Orange Counties. The infestation at Chino is about 15 miles due east of the nearest previously reported occurrence at Puente in Los Angeles County. The gradual spread throughout the south, first reported at Yuma near Winterhaven in Imperial County in 1939, is being watched with interest. So far any serious increase in numbers seems to be held down by the alfalfa weevil parasite, *Bathyplectes* sp.

The African earwig, *Euborellia cincticollis:* For the first time this insect has also been recently reported from San Bernardino County at Vidal. The nearest previously reported infestation at Blythe, Riverside County, 38 miles to the south, was submitted by Roy F. Camblin, Deputy Agricultural Commissioner, on February 26, 1954. This species was first taken in California at Ripley and Blythe, Riverside County in July, 1946. In 1950 it was reported from Indio. In October, 1953, specimens were submitted respectively from Fresno, Tranquility and San Joaquin in Fresno County, from Ivanhoe in Tulare County and from El Centro, Niland, Brawley and Winterhaven in Imperial County. This desert species is of potential economic importance due to recorded rind damage to melon, cucumber and squash at the point of contact with the ground.

The dusky-veined walnut aphid, *Callaphis juglandis:* This aphid has extended its range in California to the east side of the bay in San Mateo County. Specimens were received on September 14, 1953, from State Survey Entomologist R. P. Allen, taken on walnut at South Palo Alto. Previous records have included Santa Clara and San Mateo Counties where it first appeared in the State in August, 1952. It has a history of serious damage to walnuts in the Willamette Valley in Oregon in 1928.

The green fig beetle, *Cotinis texana:* Previously known only from Riverside County in 1934 and San Bernardino County in 1936, this beetle has apparently been gradually moving westward in Southern California. In 1947 it appeared in Orange County at Tustin and in August, 1953, at Arcadia in Los Angeles County. In the latter instance a single adult in flight was collected. In February, 1954, a larvae was taken in soil at San Gabriel as reported by L. E. Myers, Entomologist in the Los Angeles County Agricultural Commissioner's office. This species has been reported as damaging late peaches in San Bernardino County to an extent requiring control measures. More recently permission to produce and sell the larvae as live fish bait has been disapproved.

Of interest more than of economic importance is the finding of a larvae of the lotus borer, *Pyrausta penitalis,* in cotton gin trash being examined for cotton pests at Bakersfield, Kern County, and again at Corcoran in Kings County during October, 1953. It closely resembles the European corn borer and includes corn along with rhubarb among its hosts in the eastern United States. It has not previously been reported from any of the western states.

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